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ABSTRACT

Contributions from job-cluster research include greater understanding of the desired end-product of vocational education, potential for curriculum development, and better understanding of job analysis. Presentations by specialists who are presently active in research on the problems of job-clustering include: (1) "A Functional Approach to Curriculum Development" by D. Sjogren, (2) "A Conceptual Framework for the Study of Job Similarities" by J. W. Cunningham, (3) "Application of Cluster Research to Curriculum Development" by H. F. Rahmlow, and (4) "The Development, Implementation, and Field Evaluation of the Cluster Concept Program in Vocational Education at the Secondary School Level" by W. S. Mietus. Critiques of the papers are provided by E. J. Morrison and Dale G. Hamreus. (SB)

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THE JOB-CLUSTER CONCEPT AND ITS CURRICULAR IMPLICATIONS

A Symposium

J. W. CUNNINGHAM
Editor

DEPARTMENT OF PSYCHOLOGY
NORTH CAROLINA STATE UNIVERSITY AT RALEIGH

Center Monograph No. 4

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NORTH CAROLINA STATE UNIVERSITY AT RALEIGH
1969

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THE JOB-CLUSTER CONCEPT AND ITS CURRICULAR IMPLICATIONS

A Symposium

J. W. Cunningham
Editor

Department of Psychology
North Carolina State University at Raleigh

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FOREWORD

Among the many problems facing occupational education today, one of the most pressing relates to the analysis and classification of jobs. Obviously, from the point of view of attempting to improve the quality of vocational education, it is equally as necessary to know the characteristics of the product we need to turn out as well as the process by which it is produced. Research into the area of job-clustering has great potential for helping us to understand the nature of the desired end-product of vocational education. The potential for curriculum development is apparent, but that is not the only possible contribution. A better understanding of job-analysis, a necessary foundation for clustering research, should give us greater feedback capabilities in our occupational programs with a concomitant improvement in our ability to modify and redirect our occupational programs to provide the best articulation with the world of work.

The papers collected in this monograph represent the contributions of a number of scholars who are presently active in research on the problems of job-clustering. The Center for Occupational Education extends its appreciation to each of the men listed below for permission to include his paper in this volume:

Dr. Douglas Sjogren, Colorado State University
Dr. J. W. Cunningham, North Carolina State University
Dr. Harold F. Rahmlow, American Institutes for Research
Dr. Walter S. Mietus, University of Maryland

In addition to these men, Dr. Edward J. Morrison of Ohio State University and Dr. Dale G. Hamreus of the Oregon State System of Higher Education were kind enough not only to serve as discussants when these papers were presented, but also to write their comments up for inclusion in the monograph.

A special note of thanks is reserved for Dr. David S. Bushnell of the Battelle Memorial Institute. Dr. Bushnell acted as chairman of the Symposium on Job-Clustering during which these papers were presented. He also consented to write the Preface for this monograph.

Finally, the technical and clerical assistance of the Center staff is gratefully acknowledged.

John K. Coster
Director

PREFACE

Vocational education came under attack in the early 60's because of its oftentimes narrow, overly specialized focus on the development of specific job skills. Opening up career options and preparing students for their larger role responsibilities became one of the concerns of curriculum researchers who rallied to the cause of reform following the passage of the Vocational Education Act of 1963.

The ultimate goal of this effort was the development of a new and powerful vocational curriculum aimed at providing all students with entry level job skills and the necessary qualifications for multiple post-high school options. It was hoped that graduates from such a program might qualify for entry into a university or community college; or they might enter a technical school or community college for further occupational training. They should have the ability to continue their education, if necessary, in an adult education program while working. And, of course, they should have the kind of occupational skills which would qualify them for work if they so choose. The important feature of such a curriculum is that it be learner-centered with few demarcations between the academic and the vocational. Employing vocational preparation as the major vehicle, the inculcation of basic learning skills could be made more tolerable to many students who have a hard time seeing the value of general education.

Among the more important and successful research efforts likely to benefit from this larger effort has been an interest in job-clustering. The merits of job-clustering have been recognized as severalfold. First, the breadth of experience which a job-clustered curriculum offers prepares the student for a cluster of related occupations, insuring mobility and a shorter period of retaining if necessary. Second, a curriculum developed in this manner provides more relevance for students interested in not just one but a variety of occupations. Students required to develop a fundamental skill such as the addition of fractions can see its relevance to a host of occupations. Third, a cluster approach should be of some assistance in helping to break down the rigid barriers which have grown up between the different service areas of vocational education. Through job-clustering, the common job skills can be identified across service lines. Adding fractions is as important to the building trades as it is to students interested in distributive education. Fourth, clustering helps to structure a curriculum in such a way that the student completing such a program should be able to advance more rapidly up a career ladder to higher levels of responsibility and income. Thus, vertical as well as horizonal structuring should provide the student with the kinds of experiences most likely to help him advance in his career. Fifth, through job-clustering, vocational education should establish once and for all the vocational educator's interest in the "total" man. It has been recognized for some time that attitudes, personality traits, and other adaptive skills are as important determinants of occupational success as are functional job skills. Job-clustering provides curriculum developers with the tools to incorporate these requirements into their curriculum design efforts.

Advances in the state of the art of job-clustering have to a large extent been facilitated through the improvement of criteria for clustering job skills. Each of the following papers was presented at the 1969 American Educational Research Association Symposium on Job-Clustering. Those invited to participate represented the leading researchers on this topic. Each in his own way advances the earlier work of Robert Gagne, Sidney Fine, J. P. Guilford, and others. What problems to pursue further, what criteria have worked effectively, and the issues surrounding vertical and horizontal articulation of curricula; these are topics which the reader should find stimulating and provocative as he reviews each of the studies reported herein. Credit should be given to Dr. J. W. Cunningham, Center for Occupational Education, North Carolina State University, for his foresight and initiative in organizing the symposium and editing the papers for this publication.

David S. Bushnell
Battelle Memorial Institute

A FUNCTIONAL APPROACH TO CURRICULUM DEVELOPMENT

Douglas Sjogren
Colorado State University*

The Vocational Education Act of 1963 has served to stimulate efforts at curricular change in vocational education. A review of the recent writings and research on vocational education curricula has suggested to the writer that there is one concept that is common to all. This concept is that vocational curricula should not be specific to a single job, but should be designed to prepare the student to enter any one of a number of jobs in the job cluster (Sjogren and Sahl, 1966). Two well-known curriculum projects, the Richmond, California, Plan (Asbell, 1967) and the Quincy, Massachusetts, Project (Morrison, 1966) seem to be based on the job cluster concept. The Organic Curriculum of Morgan and Bushnell (Undated) also emphasizes the cluster concept. The Organic Curriculum notion is now in its implementation stage in the project called ES70. In addition to these projects which are working directly with curricular revision, there are a number of job clustering projects. The job clustering projects are all ultimately concerned with curricular revision, and the common approach is to identify job clusters that can be used as a basis for curriculum building. Among the clustering studies in vocational education are those by Rahmlow and Winchell (1965), Frantz (1966), Coster and Courtney (1965), and Sjogren, Schroeder, and Sahl (1967).

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*Now with the Center for Instructional Research and Curriculum Evaluation, University of Illinois, Urbana.

The job cluster concept seems to be a sensible and rationale base for curriculum building in vocational education. Much evidence supports the approach. For example, the fact that jobs are rapidly changing and becoming obsolete is supportive of attempts to build a generalizable base for a number of jobs rather than training a person for a specific job. Evidence on the instability of career or job choice commitments of secondary school youth is also supportive of attempts to build vocational curricula that provide a number of options for the student on completion of the curricula rather than only a few options. Support for the cluster approach also is provided by the cluster studies themselves, which have demonstrated that meaningful job clusters can be identified for curriculum building.

Despite the apparent rationality and support for the job cluster approach, there are some limitations to this approach in my opinion. The purpose of this paper is to discuss some of the limitations as I perceive them and to suggest a conceptual framework that may help to overcome the limitations. My discussion may not bring up anything new, but I hope it might effect a re-examination of the assumptions and positions of curriculum workers in vocational education.

One of the most obvious difficulties with job clustering as now employed is that of the criterion or criteria that are used for clustering the occupations. We attempted to cluster jobs on the basis of common behaviors (Sjogren, Schroeder, and Sahl, 1967); the Washington State group has used an approach which clusters on the basis of levels of knowledge in subject matter areas (Rahmlow, 1966); the Quincy Project also employed a knowledge criterion (Morrison, 1966); Coster while at Purdue used an approach that might be called a competency cluster (Coster and Courtney, 1965); and so it goes. Although no comparisons have been made of the clusters obtained from different criteria, it seems probable that there would be differences. In our study based on common behaviors, for example, feed salesmen clustered with other sales types. If a product knowledge approach were used, however, it is likely that the feed salesman would cluster with livestock producers at least as closely if not more closely than with sales types. This problem would not be important if we knew which criteria were correct ones. Unfortunately, this is not known and I have no suggestions for knowing how to determine this in any absolute sense.

I do not want to suggest that there is, or should be, one set of criteria for clustering jobs. That is not the problem. The problem is deciding which criteria are most feasible for any specific clustering situation. Jobs are multi-dimensional and they do have commonality with each other in different ways. This suggests that the curriculum builder has enough degrees of freedom so that he could establish an optimum set of clusters for the resources available to him. As yet, however, there are no guidelines available to suggest how this optimum set could be derived except through purely empirical approaches.

A second problem with the job cluster approach derives from the fact that the cluster curriculum would be rather general and most likely arranged so that only when the person completes the curriculum will he be ready for a job at the entry level. It seems to me that this is undesirable in two ways. One of the apparent problems in education today is that generality or abstraction of the general education curriculum is the thing that turns some students off. They seem to need to deal with specific and pragmatic materials. These students are the very ones for whom the vocational education curriculum is most appropriate. I am concerned that the cluster approach will result in curricula that will have the limitations of the general curricula in reaching these people. Furthermore, the cluster approach as I understand it would not do much for the dropout. The student who leaves the program prior to completion would not be considered to be prepared for any occupation. Although high school completion and program completion ought to be our goal for every student, the fact of the matter is that all students will not complete high school or the program. I feel it is very important that we design our curricula so that the person who leaves the program after any reasonable period of time does have skills and knowledge such that he can be considered to be prepared for some occupation. Perhaps this can be accomplished in a cluster curriculum, but I don't believe this provision has been given much consideration.

A third problem of the cluster approach is related to the methodology of clustering as used in some studies. We tend to use the typical job analysis techniques as we study jobs and much of our combining of jobs is accomplished on the basis of similarities as observed by job analysis. Job analysis as typically followed has, in my opinion, some very real limitations. In a job analysis we tend to focus our attention on the tasks that are observable and measurable. Furthermore, when we cluster we look at the common elements across jobs. Jacques (1956) and Brown (1960) have discussed job content in terms of two dimensions, prescribed and discretionary content. The prescribed content of a job consists of those elements about which the worker has no authorized choice, and the discretionary content consists of those elements in which the choice of how to do a job is left to the person doing it. It seems to me that job analysis procedures will tend to bring out primarily only the prescribed content of a job and the discretionary content will be ignored. Consequently, the clusters will tend to be formed on the prescribed content, but the prescribed behaviors may not actually be the important behaviors. Furthermore, the curriculum will focus on the prescribed content and ignore the discretionary content. It is probable, however, that the ability to deal with the discretionary aspects of a job is what really discriminates on the continuum of job success. Thus the curriculum built on the basis of job analysis and which stresses prescribed content may not really be a very good curriculum for training people for the job because it does not provide well for the discretionary content. At least it is an incomplete curriculum. Clustering based on job analysis also impresses me as being so objective as to be sterile. The tasks of the workers are described, but the milieu within which the tasks are done is often ignored. The environment of the worker is important and any provision that a training program might make to facilitate the worker's adaptation to his environment would be desirable.

Parenthetically, I would like to suggest that our present curriculum does not provide well for the discretionary content of jobs. I have no data to support this contention, but I have heard people, in discussing the effectiveness of workers, make comments indicating that the graduate of a training program can perform most of the expected tasks (prescribed content?) but they don't seem to want to assume responsibility or make decisions (discretionary content?). Furthermore, we sometimes criticize the employer when he says that the employee needs to be a high school graduate. On the basis of the prescribed content of the job this requirement appears ridiculous. Perhaps the employer is recognizing on an intuitive basis, however, that ability to handle the discretionary content of the job is of greater importance to him. It is likely that the discretionary content of most jobs is better handled by persons with more knowledge in more areas because successful performance on discretionary tasks is influenced by how well the person can recognize and understand the relevant variables in a situation and how they might be related. Capacity for recognizing and understanding variables is certainly related to amount of knowledge, and the high school graduate can be expected to have more knowledge than the non-graduate.

The last problem I perceive with the cluster approach is that it doesn't fit well in the present structure of vocational education. The various jurisdictional disputes that now exist among the service areas of vocational education will become even more intense as jobs that are now associated with specific service areas are clustered with jobs from other service areas. In our study, for example, we found that sales and office occupations in agriculture and metal working industries clustered together rather than with other jobs in their respective industry. This clustering resulted, of course, from the criteria we used for clustering, common job behaviors. If this kind of cluster is viable for curriculum building, how is it reconciled to the service areas of distributive, business and office, agriculture, and trade and industry education? Although this is a problem with the cluster approach, perhaps it can be regarded as a potential benefit if the cluster approach can relax some of the rigid barriers between the service areas and effect more cooperative and coordinated endeavors than now seem to exist.

Whereas present efforts at job clustering are useful in the sense of providing better description and understanding of the world of work, they have, for the reasons mentioned above and others, little utility for planning educational curricula and programs. What is needed is some sort of conceptual framework, model, or heuristic device that will permit consideration of the numerable relevant job and education variables and the relationships between and among them. In effect I am saying that we need a systematic way for describing jobs so that we can translate the information into efficient and effective curricula. The remainder of this paper represents an attempt to develop such a system. I cannot claim this as original, because I have depended very greatly on the work of Sidney Fine. The reader should actually regard this paper as an attempt to interpret Fine for the educator.

The schematic shown on the following page is a two dimensional portrayal of a proposed system for the description and clustering of jobs. The system should have a third dimension to indicate what I call vertical clustering. This dimension is discussed in a later portion of the paper, but I have not yet been able to incorporate it into the schematic portrayal in a satisfactory manner.

SKILLS

Job Requirement	Adaptive (Attitudes, personality traits)	Functional (Skills in working with Things, Data, and People)	Specific Content (Product knowledge, work procedures)
Prescribed			
Discretionary			

Fine (1967a) suggested that human performance could be classified into the three types of skill named on the horizontal dimension of the above scheme. He defined adaptive skills as "those competencies that enable an individual to accept and adjust to the physical, interpersonal, and organizational arrangements and conditions in which a job exists." The functional skills were defined as "those competencies that enable an individual to relate to Things, Data, and People in some combination according to their personal preferences and to some degree of complexity according to their abilities." Specific content skills were defined as "those competencies that enable an individual to perform a specific job according to the specifications of an employer and according to the standards required to satisfy the market."

The vertical dimension is an incorporation of the concept of Jacques (1956) and Brown (1960) into the scheme. It should be mentioned that Fine made use of these concepts in the paper cited above.

The job description system suggested by the schematic seems to have potential not only for describing jobs in a meaningful way, but also for relating these jobs to education programs. Although there are many variables within each of the cells, the three categories in the skills dimension do seem to subsume all job variables. If jobs were to be classified according to the kinds of adaptive, functional, and specific content skills that are prescribed and discretionary it should not be a difficult task to describe the kinds of educational situations that are available or that need to be provided to develop the behaviors. For example, it may be determined that clerical jobs at a particular level require that the incumbent can maintain effective social relationships as an adaptive skill, can read and interpret instructions written at a particular level as a functional skill, and knows certain technical vocabulary as a specific content skill. It should then be possible to determine the kinds of experiences that would allow for the development of these skills. Furthermore, it may be decided that some of the skills cannot be well developed in a contrived educational setting. Many adaptive skills, for example, are learned or not learned very early in life, and attempts to teach these skills later in school may be quite inefficient if not ineffective. The specification of such skills would, however, serve as a counseling tool in the sense that the person can select programs that allow him to capitalize on the skills he has developed. I would suggest, however, that we should not be too pessimistic about the school's ability to teach adaptive skills. Attitudes can be changed and can be taught.

The experience of the Job Corps in developing adaptive skills among the participants is a case in point.

In applying this scheme to a cross-sectional descriptive study of jobs, I envision a two-step procedure. I am using cross-sectional in the sense of jobs at the same skill level. The first step would be to obtain information on a number of incumbents working at the same job title. This information would permit an analysis of the skills into the prescribed skills and the discretionary skills. I would predict that the common variance would be in the cells in the first row of the matrix and the remaining real variance would be due to the discretionary behaviors for that job title. If we then related the skills of the various job titles, the common factors would indicate the skills common to the job titles. I would predict that the common variance would fall mainly in the first two cells of the top row of the matrix. I am in effect hypothesizing that jobs at a similar level will cluster mainly on their prescribed adaptive and functional behaviors and those things that make each incumbent unique in his job are the discretionary behaviors he shows. The things that make each job title unique are the specific content skills needed by the incumbent. If such is the case then the task of a training program for these jobs would be to provide primarily for the development of these prescribed adaptive and functional skills and leave the development of the skills in the other cells to the employer or some other means.

A program such as this would not be complete, however. Any program designed to prepare an individual for the world of work is not concerned only with preparation for a job at a particular level. It should also be concerned with providing the individual with levels of skill so that the indivudual will be upwardly mobile in the job. Thus a third dimension needs to be incorporated into the scheme; a dimension that would provide for the vertical clustering of jobs. Whereas in the cross-sectional clustering the prescribed behaviors are probably most influential, it would seem that the discretionary skills would emerge as the crucial skills in vertical clustering. Discretionary skills, when exercised appropriately, are probably the skills that determine success and advancement in a job. Also skills that are discretionary at a lower level job probably become prescribed at a higher level job. Thus there seems to be a strong dependence in upward mobility on the incumbent having a level of skill that enables him to exhibit appropriate discretionary behavior.

The paragraph above implies that jobs become more prescribed at a higher level than at a lower level. This would be true in the sense that an individual may at a lower level have to perform a certain function that depends on a certain skill level. If the individual has a higher level of skill, he may at his discretion perform the same function in the more efficient manner permitted by his skill level. This skill would then be discretionary at that level, but the skill may be prescribed in order to perform the necessary functions of a job at a higher level.

On the other hand, it can be argued that jobs become less prescribed at the higher level than at the lower level. Jobs at the higher level permit more decision-making and alternatives than low level jobs, but this also says that skill in decision making is prescribed for higher level jobs. Obviously, I have not been able to clarify my thinking on this point, but I do feel that with better conceptualization of what are prescribed and discretionary skills we will have a useful framework for describing upward mobility or career lines.

Although the problem indicated above is important, it does not seem to be crucial to vertical clustering. I feel we can and should proceed with attempts not only at corss-sectional clustering, but also vertical clustering. With both cross-sectional and vertical clustering we would be more able to specify the occupational or educational experience required for entry into a job at a given level, as well as the experience that would facilitate advancement in the career lines that emanate from this job. With vertical clustering of jobs we should become more able to specify the kinds of jobs for which an individual has the appropriate skills at any point in time as well as those skills that need to be developed for entry at a higher level or for advancement. Vertical clustering would also assist employers in designing career lines more effectively in that they could provide well for the kinds of experiences, either on-the-job or through training programs, that would allow the employee to capitalize on and expand his present skill levels to enable his advancement to the appropriate next higher level. Fine (1967b) has suggested a model for structuring jobs according to career lines that is very similar to what I have called vertical clustering. The model for the hierarchical analysis of school learning tasks developed by Gagne (1962) seems to me to have much potential as part of the system. The application of the Gagne model would enable the educational planner to specify the kinds and sequences of experiences that would facilitate progress in the development of the various skills. Furthermore, techniques are available for cross-sectional and vertical clustering. Factor and cluster analysis techniques have been employed successfully in the cross-sectional studies cited earlier in this paper. Ward (1961) has described a hierarchical grouping procedure that has been used successfully for vertical clustering of Air Force jobs. A recent article by Johnson (1967) has described a procedure that might be used for a combined cross-sectional and vertical clustering.

The approach suggested herein has several implications for education, especially vocational education. The emphasis of vocational education would change from preparation for a job to skill development, especially adaptive and functional skills.

The objective of the curriculum would not be that a student is ready to enter a specific job, but that he will have attained certain kinds and levels of skill that will enable him to enter any of a number of jobs.

By focusing on skill development rather than preparation for a specific job, the vocational educator would be able to assume responsibility not only for occupational preparation but also for the very real liberal education aspects that the skills he teaches have. Furthermore, it would enable us to recognize better and capitalize more fully on the skills that are being developed in the general education curriculum. General educators would become more cognizant of the responsibility they have for development of job related skills and more aware of the relevancy of their courses to the world of work. In effect the approach would tend to blur the distinction between vocational and general education and result in truly "general" education as defined by Broudy, Smith, and Burnett (1964).

> American secondary education can and should be general education, meaning by 'general' that what is taught should consist of those central skills, ideas, and evaluations which can be most significantly and widely used in order to deal with life in our times. This notion in contrast to that which holds general education to be a survey of generally everything. (p. 10)

I have discussed in another paper other specific implications of this approach. Perhaps such a discussion is premature, however, until it can be determined whether the proposed model is viable for describing jobs and relating the descriptions to educational programs.

I see much similarity between what I have written in this paper and what is being done in the ES70 Project. Hopefully this paper may provide some ideas about how the job clustering component of the ES70 Project might be implemented.

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A CONCEPTUAL FRAMEWORK FOR THE STUDY OF JOB SIMILARITIES

J. W. Cunningham

North Carolina State University[1]

The present and projected state of flux in our society would seem to require that today's worker be a rather flexible entity, that he possess the ability to adapt to a rapidly changing and somewhat unpredictable world of work. As Dr. Sjogren noted, there is an opinion approaching consensus among educators that vocational curricula should provide students with capabilities which are transferable across jobs. One approach developed in response to this demand has been termed "job clustering," which could be defined as the establishment of job families, or groups, with similar educational requirements. The assumption behind this concept is that a student exposed to a curriculum developed for a cluster of jobs should be better prepared--compared to the person trained for a specific job--to adapt to changing occupational demands. Evidence supporting the need, viability, and acceptance of the cluster approach can be found in recent work reported from the University of Maryland (Maley, 1966), which Dr. Mietus will discuss later in the program. The popularity of the cluster concept is evidenced by the number of papers and research reports written on the topic in recent years and by its current implementation in a number of action programs around the country.

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[1] Center for Occupational Education and Department of Psychology

After reviewing the literature on job clustering, however, my associates and I at the Center for Occupational Education felt there were still questions in this area warranting further conceptual development and research. The problem of particular interest to us pertains to the types of variables one might consider in attempting to form clusters of similar jobs. That is, what are the classes of characteristics on which jobs might be measured and compared, and what are the advantages and disadvantages of these characteristics in establishing job similarities for educational purposes? Our identification of this problem was based on the axiom that a prerequisite to classifying objects or events is the definition of a set of characteristics on which the phenomena can be compared.

Previous research involving the definition and measurement of job variables might be subsumed under three broad categories: (1) studies in which jobs were rated on basic human attribute requirements (such as aptitudes, motor abilities, and physical capacities); (2) attempts to measure and compare jobs on knowledge and skill elements; and (3) studies employing activity or behavior elements for job-analysis purposes. Some examples of this research are cited on Page 29.[2] A few of these studies employed more than one class of variables; in such cases, an assignment was made to the one category that seemed to best represent the major approach of the study in question. The studies starred on Page 29 were conducted with educational or curricular purposes in mind, while the others were done within such contexts as employee-selection and placement, counseling, and job evaluation. The investigations dealing with the basic attribute requirements of jobs, for example, are not particularly relevant to the problem of establishing job similarities for curricular purposes, although some of the techniques employed in these studies might be applied in that area. Most of the studies of job similarities that have been conducted within an educational context have dealt with restricted populations of jobs, and for that reason have employed variables defined specifically for these populations. Typically in these studies, limited samples of jobs or occupations have been rated on knowledge and task items derived from the samples for the purpose of identifying items which were common among the jobs. However, the items employed in these studies would have rather limited applicability to occupations or jobs other than those from which they were derived.

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[2] The illustrations which accompanied this presentation are shown on pp. 29-38.

Two notable exceptions to the focused or inductive approach to defining job variables include a study conducted by Sjogren, Schroeder, and Sahl (1967), who employed basic worker behaviors as job variables, and an investigation reported by Hamreus and Langevin (1967) dealing with the basic worker functions and mental processes involved in jobs. Although there is a definite purpose to be served in analyzing jobs at a specific and detailed level, it would seem that further attention should also be directed to the problem identified in the Hamreus and Sjogren studies; that is, to defining variables relevant to a broad spectrum of jobs.

This is the problem we are now considering in a project at the Center for Occupational Education. It is our opinion that a considerable amount of basic research remains to be done in the area of job clustering, both in the development of conceptual approaches, or frameworks, for the definition of job variables and in the validation of measuring instruments or techniques based on these schemes. For the purposes we have in mind, a practical approach to the study of job similarities would involve the use of variables having (1) applicability to a wide range of jobs, (2) sufficient concreteness (i.e., relation to physical objects or events) to be used reliably by job analysts, and (3) implications for education or training.

In looking for a broad conceptual approach to the problem, we decided that at the risk of appearing a bit simple-minded, we would begin explicitly with the basic premise underlying all education and training; namely, that what is learned in one situation will transfer to others. Thus, when we speak of grouping jobs or occupations for educational purposes, we are assuming that jobs within a given cluster are similar in the sense that certain core educational experiences could be established which would facilitate the learning or performance of all jobs within the cluster. This assumption is diagramed at the top of Page 30. We might also assume, as shown at the bottom of the same page, that if two or more jobs are similar in this first sense (that is, if they belong in the same educational cluster), then certain habits or capabilities acquired in learning to perform one of these jobs should transfer to the others; that is, we could reasonably expect at least some positive transfer among jobs within an educational cluster, as just defined.

It is this latter assumption that we are hanging our hat on. We are assuming for operational purposes that similarities among jobs can be reliably and validly measured on the basis of job-analysis items developed within a framework formed by certain concepts and principles relevant to learning transfer. If a research tool in the form of a job-analysis instrument could be developed on this basis, it might be possible to analyze a sample of jobs with the instrument, compute a similarity (or transfer) index between each pair of jobs in the sample, and establish subgroups (or clusters) of similar jobs on the basis of these transfer indices. These subgroups could be formed through the application of certain mathematical procedures (such as hierarchical clustering analysis) to the matrix of similarity indices.

An outline of our project, as we presently envisage it, is shown on Page 31. Our first objective is to develop a conceptual framework, or taxonomy, from which to define items which might prove useful in analyzing jobs for educational purposes. We have recently started on this phase of the project and have spent most of our time to date reviewing the experimental literature relevant to learning transfer. This seemed like a reasonable place to start, since much of the basic research related to transfer has been done within the S-R (stimulus-response) context. We have begun, however, to explore the psychometric approach to transfer propounded by G. A. Ferguson (1954, 1956), J. P. Guilford (1950, 1961) and others; and it is likely that we will also borrow some concepts from the information-processing, or systems, approach. Certain concepts, then, will be drawn from these three areas and combined into an eclectic--but hopefully not syncretic--general framework, which will be used in defining and interrelating job variables. I would hasten to add--though it is probably already apparent--that this will not be a rigorously deduced model, but rather what R. B. Miller (1962) might refer to as a "heuristic description" of job variables. It is hoped, however, that this classification scheme will allow us to approach the study of job similarities in a reasonably analytical and potentially useful way.

As mentioned before, we are interested in defining variables which would apply to a wide variety of jobs. For this reason, we have decided to attack the problem at a human requirement level comparable to J. W. Altman's (1966) general vocational capabilities, which he defines as sets of ". . . skills and/or knowledges having relevance to a variety of occupations which go beyond the basic academic tools of reading, writing, arithmetic, and understanding of general science." It might be useful to consider this concept within the framework shown on Page 32. Thus, we could think of the acquisition of job capabilities in a developmental sense, where more basic and general abilities are integrated into successively more complex and specific job-related capabilities. This idea is meant to correspond, in a rather liberal way, with Gagné's (1962) conception of a hierarchical arrangement of subordinate knowledges, or sets. Under this scheme the capability of performing a task at a given level is the result of a combination of more basic prerequisite capabilities.

In selecting the concept of general vocational capabilities as an approximate human counterpart to our job variables, we reasoned that an attempt to account for the more specific and numerous job-related capabilities at a higher level would require that we appreciably restrict the population of jobs to which our variables would apply. On the other hand, at a level lower than general vocational capabilities, we would begin to delve into general-academic rather than vocational education. So, although we will vary to some extent on either side of the horizontal arrow in the Page-32 diagram, our job variables will be oriented primarily toward this level, or class, of human requirements of jobs.

When submitting the title of this paper a few months ago, I had anticipated that we would have completed the conceptual development phase of our project by now. I am sorry to report that our PERT chart lied. However, since I promised "A Conceptual Framework for the Study of Job Similarities," I will present the crude beginning of a taxonomy of job variables which my associates, J. R. Floyd and T. C. Tuttle, and I are currently trying to develop.

A tentative and skeletal outline of this classification scheme is shown on Page 33. The three major categories of variables derive from the learning psychologist's stimulus-organism-response paradigm, which seemed compatible with the basic rationale of our study. In selecting this model, we borrowed from a similar approach taken by E. J. McCormick at Purdue University (McCormick _et al_., 1967), who has defined job-analysis items under the information-processing paradigm of Input, Mediation, and Output. Implicit in the scheme we are proposing is the assumption that the transfer of job capabilities involves such mechanisms as stimulus and response generalization, mediated generalization, and a little-explored mechanism discussed by D. E. Berlyne (1965), S-R generalization. We have adopted the S-O-R paradigm primarily for heuristic or descriptive purposes, however, and are not prepared to specify just how these mechanisms operate in relation to our job variables, which are intended to represent relatively molar categories of stimulus input and response output. As I mentioned earlier, we are also incorporating into our taxonomy certain psychometric and information-processing concepts.

Under Stimulus Input, we have adopted J. P. Guilford's (1967) four content categories: Figural, meaning directly preceived objects and events; Symbolic Content, consisting of letters, digits, and other conventional signs; Semantic (or verbal) Content; and Behavioral Content, a category we have broadened to include nonverbal human behaviors. These four content categories are compared on Page 33 with the categories of People, Data, and Things proposed by S. A. Fine (1955, 1957). We have also devised another, rather crude, set of categories which we have labeled Source of Stimulus Input. The source categories include Direct Input, Response-Dependent Input, and Job Goals--the job goals being defined as prescribed environmental states signifying the successful completion of tasks or duties. We feel that the goal concept could be important in the study of job similarities, since it plays a role in both the S-R (e.g., Hull-Spence) and cognitive (e.g., Lewin, Tolman) explanations of transfer.

Also included under Stimulus Input is a major category labeled Context, representing those environmental variables that, although not involved in the direct flow of information input, set the stage in which job behaviors occur. McCormick divides these into the physical and social aspects of jobs. As diagramed at the top of Page 34, the Content and Source categories might be thought of as entering into a cross-classificatory structure with the three major sensory channels. At the bottom of the same page are some examples of narrower classes of stimulus variables, which might fall under R. B. Miller's (1962) definition of "indicators." We have given little thought to date to the development of goal variables but have included some broad categories of goal states on Page 35 merely to define this concept in a rough operational way.

At this time, we are considering four major categories of Mediational variables, as shown on Page 33: Processes, Abilities and Knowledges, Affective States, and Psychomotor Skills. Three of these categories would correspond to the Cognitive, Affective, and Psychomotor domains proposed by B. S. Bloom and others (1956) in the Taxonomy of Educational Objectives. We have not begun work on the mediational part of our classification scheme; but presented on Page 36 are some examples of processes, affective states, and abilities and knowledges that could be included under this category. We are particularly interested in the General Vocational Capabilities tests developed for research purposes by J. W. Altman and his associates, since, as I mentioned earlier, it is intended that our job variables correspond to this general level of human requirements. We are considering the possibility of weighting, or scoring, the more concrete stimulus and response variables on certain mediational variables, such as general vocational capabilities. If this could be successfully accomplished, it might prove feasible to have analysts rate jobs on the relatively concrete stimulus and response variables and then to derive, indirectly from these ratings, job-requirement scores on the more abstract mediational variables. This procedure has been used with some success by E. J. McCormick in deriving aptitude requirement scores for jobs.

The Response (or behavior) section of our taxonomy, as it stands now, is an adaptation of ideas borrowed from Fine and McCormick. Some classes of physical activities and related variables are shown on Page 37. These are divided into Integrative Physical Activities, Objects Acted Upon, and Body Requirements--a class which overlaps to some extent the category of Psychomotor Skills mentioned earlier under Mediation. Page 38 presents some classes of Representational and Interpersonal Activities. (A representational activity, as we define it, involves semantic or symbolic output.) You can see that our response categories are quite broad and will require further subdivision.

As I mentioned before, this taxonomy of job variables is tentative and is intended mainly to illustrate the general approach which we are taking in the study of job similarities. We anticipate that our classification scheme will undergo considerable change and elaboration within the next few months. I think, however, that many of these concepts, taken by themselves, are basically sound, since we have appropriated them from reputable sources. In this regard, I would like to acknowledge explicitly the work of both E. J. McCormick and S. A. Fine; we borrowed rather heavily from their ideas.

Time will not permit a lengthy discussion of our plans for the project; however, these are outlined on Page 31. We plan to develop a job-analysis instrument based on a taxonomy of job variables, apply this instrument to a sample of jobs, and then attempt to correlate ratings of these jobs on the instrument with the vocational capabilities test scores of incumbents or graduate trainees in the jobs. (For this purpose, we plan to use Altman's general vocational capabilities tests and possibly some other measures.) The assumption of our validation procedure would be that jobs which are similar based on an analysis with our instrument should also be similar in terms of the average vocational capabilities scores of their incumbents.

We hope to determine from the results of this project whether there are advantages to our approach which would warrant its further consideration as a means of analyzing jobs for educational purposes.

ILLUSTRATIONS

CLASSES OF PREVIOUSLY EMPLOYED JOB VARIABLES

BASIC HUMAN ATTRIBUTES: Aptitudes, Motor Abilities, Physical Capacities, Temperaments, and Interests.

Jaspen (Pennsylvania State College, 1949)
McCormick, Finn and Schieps (Purdue University, 1957)
Norris (U. S. Air Force, 1956)
Orr (Columbia University, 1960)
Primoff (U. S. Civil Service Commission, 1957, 1959)
Trattner, Fine and Kubis (U. S. Employment Service, 1955)

KNOWLEDGES AND SKILLS:

Combs and Satter (University of Michigan, 1949)
*Maley and others (University of Maryland, 1966-1967)
*Rahmlow and others (Washington State University, 1966-1967)
*Schill and Arnold (University of Illinois, 1965)

ACTIVITIES OR BEHAVIORS:

*Hamreus and Langevin (Oregon State System of Higher Education, 1967)
Lawshe and Steinberg (Purdue University, 1955)
McCormick and others (Purdue University, 1967)
*Morsh (U. S. Air Force, 1965)
Palmer and McCormick (Purdue University, 1959)
*Sjogren, Schroeder and Sahl (Colorado State University, 1967)
Thorndike and others (U. S. Air Force, 1957)

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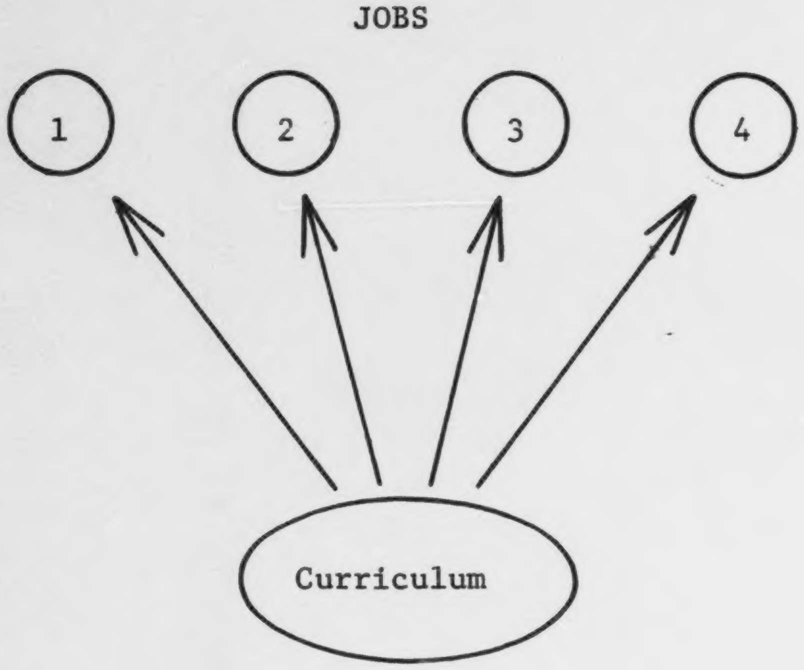
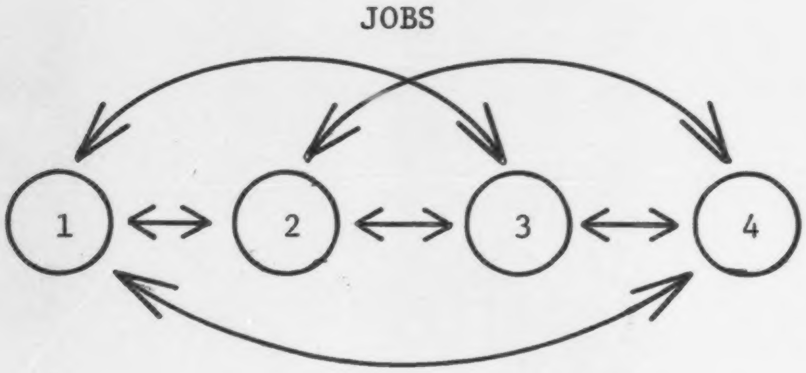
*Conducted within an educational or training context.


JOBS
1
2
3
4
Curriculum

(Positive transfer from core curriculum to jobs within a cluster)



(Positive transfer among jobs within a cluster)

OBJECTIVES OF THE PROJECT

(1) Develop a conceptual framework (based on concepts and principles of learning transfer, psychometrics, and systems theory) for defining and interrelating classes of variables which might prove useful in establishing job similarities for educational purposes.

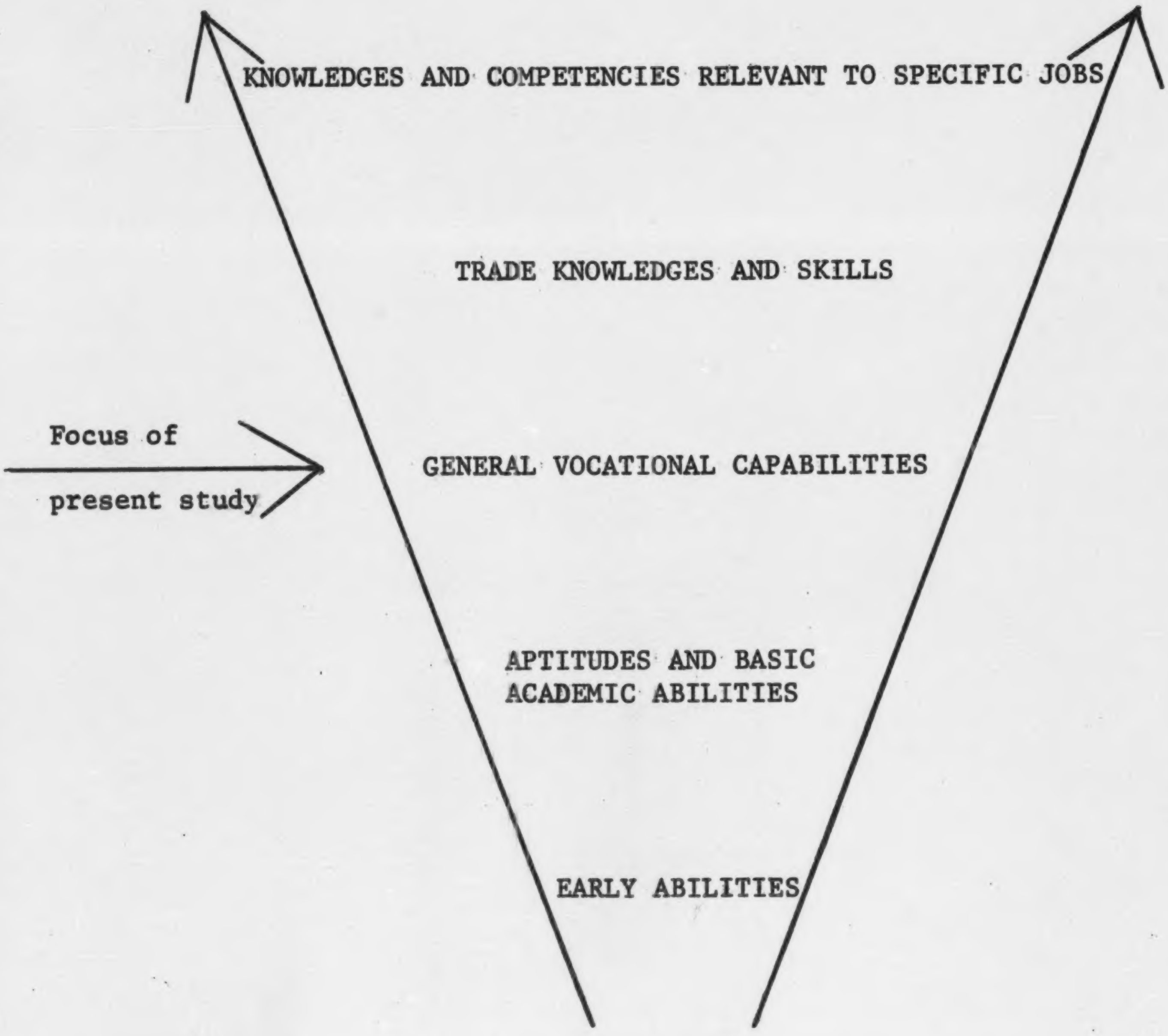
(2) Apply this model in the development of a job-analysis instrument to be used in measuring similarities among jobs.

A. Define job variables
B. Write job-analysis items
C. Scale the items

(3) Apply the instrument to a sample of jobs for tryout purposes and to determine the inter-rater reliabilities of the items.

(4) Validate the instrument against the vocational capabilities test scores of job incumbents or graduate trainees.

(5) Compare the results of job ratings on the instrument with job measures obtained using other techniques and instruments.


KNOWLEDGES AND COMPETENCIES RELEVANT TO SPECIFIC JOBS
TRADE KNOWLEDGES AND SKILLS
Focus of present study
GENERAL VOCATIONAL CAPABILITIES
APTITUDES AND BASIC ACADEMIC ABILITIES
EARLY ABILITIES

CLASSES OF JOB VARIABLES

STIMULUS (INFORMATION) INPUT

CONTENT

Figural - Things
Symbolic
Semantic } - Data
Behavioral - People

SOURCE

Direct Input
Response-Dependent
(Feedback)
Job Goals

SENSORY CHANNEL

Visual
Auditory
Tactual/Kinesthetic

CONTEXT

Physical
Social

MEDIATION

PROCESSES

ABILITIES AND KNOWLEDGES

- Aptitudes and Basic Academic Abilities
- General Vocational Capabilities

PSYCHOMOTOR SKILLS

AFFECTIVE STATES

- Interests
- Attitudes
- Needs--Job Incentives

RESPONSE (BEHAVIORAL) OUTPUT

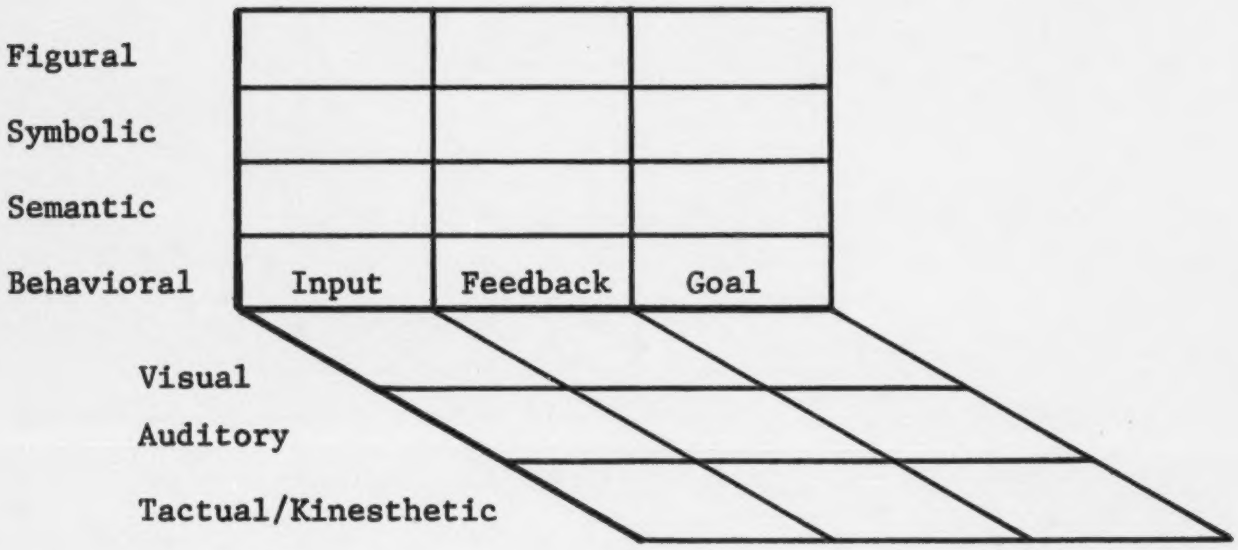
PHYSICAL ACTIVITIES

- Integrative Physical Activities
- Body Requirements
- Objects Acted Upon

REPRESENTATIONAL ACTIVITIES

- Symbolic
- Semantic

INTERPERSONAL ACTIVITIES


Figural
Symbolic
Semantic
Behavioral
Input
Feedback
Goal
Visual
Auditory
Tactual/Kinesthetic

STIMULUS VARIABLES: DIRECT INPUT

Figural*

Mechanical Devices
Materials in Process
Natural Environment
Man-Made Environment
(Structures, Buildings)
Tools
Events or Circumstances
Art or Decorative Objects
Drawings

Symbolic*

Numerical (Data, Equations, etc.)
Graphs, Figures
Measuring Devices
Visual Displays (Dials, Gauges, etc.)

Semantic

Written Materials
(Publications, Reports, Memos, Articles, Job Instructions)
Formal Speech
(e.g., Presentations)
Conversational Speech

Behavioral

Speech (Qualitative and Temporal Aspects)
Gestures, Movements, and Expressions

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*Examples adapted from McCormick (1967)

STIMULUS VARIABLES: GOAL STATES

FIGURAL

States or conditions of:

- Materials
- Mechanical Devices
- People and Animals

SEMANTIC

- Written Products
- Oral Products

SYMBOLIC

Results of:

- Encoding and Decoding Operations
- Numerical Operations
- Data Arranging (Graphs, Figures, Tables, etc.)

BEHAVIORAL

Behavior of others warranting conclusions about their:

- Attention
- Psychomotor Abilities
- Affective State
- Cognitive State
- Physiological State

MEDIATIONAL VARIABLES: CLASSES AND EXAMPLES

PROCESSES

Altman (1966)

- Sensing
- Detecting
- Discriminating
- Coding
- Classifying
- Estimating
- Chaining
- Logical Manipulation
- Rule Using
- Decision Making
- Problem Solving

Guilford (1967)

- Cognition
- Memory
- Divergent Production
- Convergent Production
- Evaluation

AFFECTIVE STATES

Interests

Kuder (1948)

- Outdoor
- Mechanical
- Computational
- Scientific
- Persuasive
- Artistic
- Literary
- Social Service
- Clerical

Gordon (1967)

- Business
- Outdoor
- Arts
- Technology
- Service

ABILITIES AND KNOWLEDGES

Aptitudes & General Academic Abilities

DAT

- Verbal Reasoning
- Numerical Ability
- Abstract Reasoning
- Clerical Speed
- Spelling
- Sentences
- Mechanical Reasoning

GATB

- Intelligence
- Verbal Aptitude
- Numerical Aptitude
- Spatial Aptitude
- Form Perception
- Clerical Perception

General Vocational Capabilities (Altman, 1966)

- Mechanical (7 areas)
- Electrical
- Spatial (2 areas)
- Chemical-Biological (4 areas)
- Symbolic (2 areas)
- People (5 areas)

RESPONSE (BEHAVIORAL) OUTPUT

Physical Activities

Integrative Physical Activities[1]

- Lifting/Carrying/Moving
- Arranging/Positioning
- Manipulating
- Material-Controlling
- Modifying
- Assembling/Disassembling
- Driving-Operating
- Operating-Controlling
- Precision Working

Objects Acted Upon[2]

- Handtools (Manually Powered)
- Handtools (Powered)
- Other Hand Devices
- Stationary Devices (Machines/ Equipment)
- Control Devices (Knobs, Handles, Pedals, Wheels, etc.)
- Mobile and Transportation Equipment
- Materials
- People & Animals

Body Requirements[2]

- Finger Manipulation
- Hand-Arm Manipulation
- Eye-Hand Coordination
- Eye-Hand-Foot Coordination
- Blind Positioning
- Mobility (Kneeling, Stooping, Crawling, etc.)
- Agility
- Standing
- Walking
- Climbing

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[1] Adapted from Fine (1955, 1958) and McCormick (1967)

[2] Adapted from McCormick (1967)

RESPONSE (BEHAVIORAL) OUTPUT

Representational Activities

Symbolic[*]

Copying/Recording
Comparing
Computing
Compiling

Semantic

Writing
Conversing
Formal Speaking

Interpersonal Activities[*]

Speaking-Signaling
Socializing
Persuading
Diverting-Entertaining
Supervising
Instructing
Negotiating
Advising/Counseling

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[*] Adapted from Fine (1955, 1958)

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APPLICATION OF CLUSTER RESEARCH TO CURRICULUM DEVELOPMENT

Harold F. Rahmlow

American Institutes for Research*

Any viable curriculum should be based upon the foreseeable needs of the learner. In a culture such as ours in which technological developments are producing rapid change, it is important that the most up-to-date information available be utilized in curriculum planning. The major purpose of our cluster research at Washington State University was to identify clusters of knowledges and competencies most likely to maximize career-long occupational opportunity and choice of non-college-bound youth in an evolving technological society. Others on the panel have dealt with the conceptual as well as the theoretical and methodological aspects of job-clustering. I wish to concentrate on the use of the data for curriculum development and upon the use of the concepts of clusters for the individualization of education.

The objective of our task-and-knowledge cluster studies was to collect and analyze facts about major types of tasks performed by workers in occupations most likely to employ substantial percentages of non-college-bound youth. As was previously reported at AERA, occupations in the studies included retailing, office work, building trades, electronics, food service, child care, and agriculture (Rahmlow, 1967). Through analysis of the data, it was possible to determine clusters of tasks and knowledges useful in a variety of occupational fields. Students who study a curriculum based upon clusters are more likely to be prepared to enter the family of occupations defined by the clusters. We sought to define clusters which would maximize a student's future occupational choice. On the other hand, the designation of job clusters also enables the identification of areas of work which require greater specialization. If major tasks for a given job fall outside the cluster area, it is unlikely that general education for the cluster will contribute significantly to success in the specialized job. When this type of information is available to curriculum developers, students, teachers, and parents, the consequences of specialization will be more apparent. The knowledge of these consequences makes it more likely that intelligent educational decisions will be made.

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*The majority of the work reported was carried out while the author was at Washington State University.

Instructional Objectives

In our work at Washington State University, we tentatively identified tasks performed by individuals in the selected occupational areas. After collecting and analyzing data from employees in the Pacific Northwest, it was possible to specify certain job tasks which were performed by a wide variety of individuals both within and between occupational areas. Because these items were in general at the task level, it was possible, upon analysis of the clusters, to derive objectives directly from the cluster work. For example, from the task, "Figure cash and trade discounts," it is known that the worker must work with percents. Therefore, it is possible to develop the objective, "Solve percentage problems of the form A = % x Base, for either A, %, or Base, given the other two." If the student masters the objective on percent, it is more likely that he will be able to perform the discounting task. As you are well aware, Gagne has recommended that objectives be pitched at a level of specificity comparable to tasks (Gagne, 1965). Therefore, by making the original cluster instrument a task instrument, the job of specifying behavioral objectives was greatly simplified. Since curriculum structure is very much interrelated with objectives, it is desirable that the clustering procedure facilitate the development of objectives. There are numerous aspects of developing objectives, among them deriving and selecting objectives (Mager, 1968). The cluster approach to curriculum development facilitates both the derivation and the selection of objectives. The derivation of objectives is facilitated by the development of a cluster instrument. That is to say, when an instrument for cluster analysis is developed, the elements for possible inclusion in the curriculum are set forth. Because the methodology of clustering is contracting rather than expanding, it is important to begin with an adequate universe of tasks. It is not within the scope of this presentation to consider extensively the original construction of a task instrument; however, the methods of task analysis and the critical incident technique would be worthy of consideration. The clustering itself is extremely useful in selecting objectives. In fact, one of the strong arguments for cluster research is that it provides an empirical basis for selecting objectives.

Selection of Learning Activities

At this time it is not appropriate to explore in depth the development of vocational instruction as Mager and Beach have done; but to further illustrate some benefits of cluster research, I will provide a limited discussion of instructional development (Mager and Beach, 1967). It is necessary to select the appropriate learning activities to facilitate the acquisition of the objectives. Here again the concept of cluster research has much to offer. Many critics of behavioral objectives have insisted that objectives are unnecessarily restrictive when they dictate content. Along with many other advocates of behavioral objectives, I would agree with this criticism as long as the objective itself is not content-based. If, as a result of clustering, a content-based objective is generated, then the development of learning activities for this objective is relatively well defined. On the other hand, if the clustering produces objectives which are not content based, the clustering still may provide clues to possible learning activities. Because there are a variety of learning activities which can be associated with a given behavior, and because of individual differences in learning styles, it is desirable to have more than one approach to the instructional process. Although the job clusters themselves may not provide information on the development of learning activities, the source of these job clusters does. Let me give you an example from the work done at Washington State University. One of the elements that came out of some cross-area job-clustering was adding fractions. The addition of fractions is in itself a non-occupational specific performance. On the other hand, knowing the situations in which the employee will be required to add fractions produces a strong motivational tool for the practice of the performance. The student is likely to be motivated to practice the addition of fractions if the problems are relevant to an area of his interest. So, if I know that the cluster element of adding fractions came from not only the area of building trades but also the area of distributive education, a teaching-learning process can be developed which allows the individualization of instruction to take advantage of specific student interest. Applications meaningful to a student interested in the building trades as well as applications meaningful to a student interested in distributive education can be developed. In practicing addition of fractions, one student may concentrate on problems involving sums of board-feet measurement and another on problems involving sums of lengths of yard goods. It should be noted that although taking advantage of the interest in an individual area, we are not likely to hamper materially the transferability of the skill.

Evaluation

Evaluation of clusters after they have been developed includes evaluating the instruction associated with the curriculum development on both a short- and a long-term basis and evaluating the correctness of the clusters themselves. As far as evaluating the effects of the instruction itself, it is sufficient for the present discussion to say that to be satisfactory, the evaluation must be satisfactory in terms of both the short-range evaluation while the student is still under the influence of the instructor, and cooperative evaluation between the employer and the educational agency to determine the long-range effects of the training. Turning to the evaluation of the clusters themselves, it is desirable to cross-validate the determination of the job clusters with future performance on the job. After all, it is a goal of job-clustering to provide for the development of competent employees.

Therefore, it is only logical to check this assumption. If the effects of instruction for the clusters have been evaluated and have been found to be effective, it is then possible to evaluate the employee's performance relative to the requirements of the job. If his performance on the job is satisfactory, we have completed the cycle of (1) identifying elements in a job cluster, (2) teaching these elements, and (3) having the employee perform satisfactorily. On the other hand, if the employee is not performing satisfactorily on the job, in spite of the fact that he can perform the behaviors expected of him by the curriculum, then we know that our clustering has not been entirely successful. Obviously, at this point further work would be required to refine our cluster technique.

Individualizing Education

The cluster approach provides a great deal of information about the relative importance of certain curricular elements in various occupational areas. In addition to providing a basis for generalizing curriculum, clustering also provides a basis for the individualization of a student's educational program. No matter how successful clustering techniques may be, it is inconceivable that a single-track curriculum can ever be developed which will meet the needs of all. Because no single curriculum can meet the needs of all, it is necessary for students to become competent in some areas at the expense of other areas. Since selection is ultimately going to be necessary, it is desirable to have in the hands of those making the decisions as much information as possible upon which to make an intelligent decision. Cluster research provides one basis. In the earlier grades in school, it is possible to inform students of certain characteristics of job families and to teach a curriculum based upon what might be called the "original educational cluster." It was discovered long ago that reading is a skill which is not only generalizable across a wide variety of occupations but also extremely useful in everyday life. Therefore, one of the primary goals of education for ages has been the development of reading competency. Contrast such an obvious curriculum element as reading with some of the curricular elements taught in the high schools, junior colleges, and graduate schools. There is not a very large segment of the population that finds it desirable to be able to factor-analyze a correlation matrix! It is desirable even at the graduate level to have a student who at the same time is a generalist and a specialist in a given area. Because these two terms are contradictory, choices must be made. The point is that by providing occupational information based upon job families in cluster research to students, educators, parents, and other concerned individuals, it is possible to individualize a student's educational program based upon his long-range needs.

The concept of providing occupational information in the lower grades based upon job families and providing specific information as the student progresses in his educational career and becomes aware of his own strengths and limitations is an integral part of the development of Project PLAN (a Program for Learning in Accordance with Needs). In the conceptualization of Project PLAN, John C. Flanagan saw the need for developing an educational program which takes into account the student's strengths and weaknesses and the environment in which he will be living and working (Flanagan, 1967). In an individualized educational program such as this, the results of cluster research will become more important as students, teachers, and parents become increasingly sophisticated in making individualized educational decisions.

An instance of individualization of instruction through cluster research has occurred in the area of mathematics. Work at Washington State University has indicated a number of curriculum elements common to a wide variety of occupational situations (Rahmlow and Winchell, 1966). After identification of these elements, specific behavioral objectives and instructional materials in the area of mathematics were developed. Because behavioral objectives are incorporated into the cirruculum materials, and diagnostic evaluation is available for these objectives, it is possible for a student to individualize his instructional program according to his needs (Rahmlow, 1968).

In closing, I wish to say that cluster research can play an extremely important role in the development of curriculum and in the guidance of students selecting elements of curriculum to be studied. I believe it is these two points, (1) the use of cluster data for the development of curriculum, and (2) the use of cluster data for the individualization of a student's educational program that represent the real promise of cluster work.

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THE DEVELOPMENT, IMPLEMENTATION AND FIELD EVALUATION OF THE CLUSTER CONCEPT PROGRAM IN VOCATIONAL EDUCATION AT THE SECONDARY SCHOOL LEVEL

Walter S. Mietus

Industrial Education Department

University of Maryland

The research reported herein was performed pursuant to grants with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education Position or policy.

The current year, 1969, marks the fourth year of research with the Cluster Concept Program and the initiation of phase four. The program has its foundations in three years of continuous research supported by the U. S. Department of Health, Education, and Welfare. The purpose of this paper is to present briefly the major efforts and progress made in these three years.*

Phase I, or the first year efforts began in September of 1965. During that phase an investigation of the need for and a rationale for the cluster concept approach to vocational education was made with due consideration of recommendations and findings of previous research in various related fields. Supportive evidence to build a rationale and evidence of the need for the cluster approach were found in many sources. One hundred and sixty studies from the fields of guidance, vocational placement, education, military training, and psychology were reviewed;

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*For detailed information relevant to the first three years of research and development, reference should be made to the previous documents which emerged as products of this investigation. To obtain these documents, interested individuals should write to either the ERIC Documentation Center at the Ohio State University or to the National Cash Register Company of Bethesda, Maryland. The materials can be obtained by making reference to the principal investigator, Dr. Donald Maley, or to the designated ERIC numbers given below.

Course Outlines		Instructional Plans	
1966		1967	
Final Report	ED010301	Final Report	ED016841
Construction	ED010302	Construction	ED016842
Electro-Mech	ED010303	Metals	ED016843
Metals	ED010304	Electro-Mech	ED016844

and pertinent findings were presented as a justification for this approach to vocational education.

The cluster concept as envisioned, was aimed at the preparation of eleventh and twelfth grade youth for entry level capability in a variety of related rather than specific occupations. It was based on the premise that educational experiences with a range of related occupations appear defensible for most secondary students who have no realistic basis for decision making along the lines of selecting a specific trade. The cluster concept program was designed to enhance the individual's potential employability by virtue of offering a wider range of entrance skills and a level of articulation across several occupations areas. This type of fundamental training, it is believed, will enable the individual to move back and forth over several occupational categories as well as vertically within the occupation.

The cluster approach, as an alternate form of vocational education, would provide a secondary student with a greater degree of flexibility for vocational decision making rather than demanding a commitment to the "one-goal" directed traditional program. The student would gain experience in a family of related occupations with many commonalities of human requirements.

Field research for determining the acceptability and feasibility was conducted by the research staff by gathering data on the attitudes, opinions, and beliefs of responsible civic and industrial leaders. The data gathered from these individuals strongly tended to support the premise that students with a cluster concept background would be excellent potential employees and would be less difficult to adapt to work in a rapidly changing technological society. The data gathered also indicated that the implementation of the program into the public schools would not present any major difficulties and that graduates from these programs would be considered employable individuals.

With heavy and often total reliance on representation from business and industry, the research staff evolved a system and criteria for establishing occupational clusters, specific occupations within the clusters, and finally, the elements or tasks for all level I and level II job requirements. The following criteria were used:

The occupational cluster:

1. Should be in the area of vocational industrial education.
2. Should include occupations that are related on the basis of either similar processes, materials, products, or human requirements.
3. Should be broad enough to include occupations with a wide variety of skills and knowledge.
4. Should involve occupations that require not more than a high school education and/or two years beyond high school.
5. Should provide for the opportunity for mobility on a geographical and occupational basis.

The three clusters established through the application of the criteria and limitations set forth this research are presented in Figure 1. More clusters were possible but the decision was made to limit the study to three. Each of the clusters was analyzed to establish special occupations for each category. See Figure 1. The following criteria were used for selection. The occupation must have:

1. A favorable employment outlook.
2. The instructional capability of being implemented in a secondary school program.

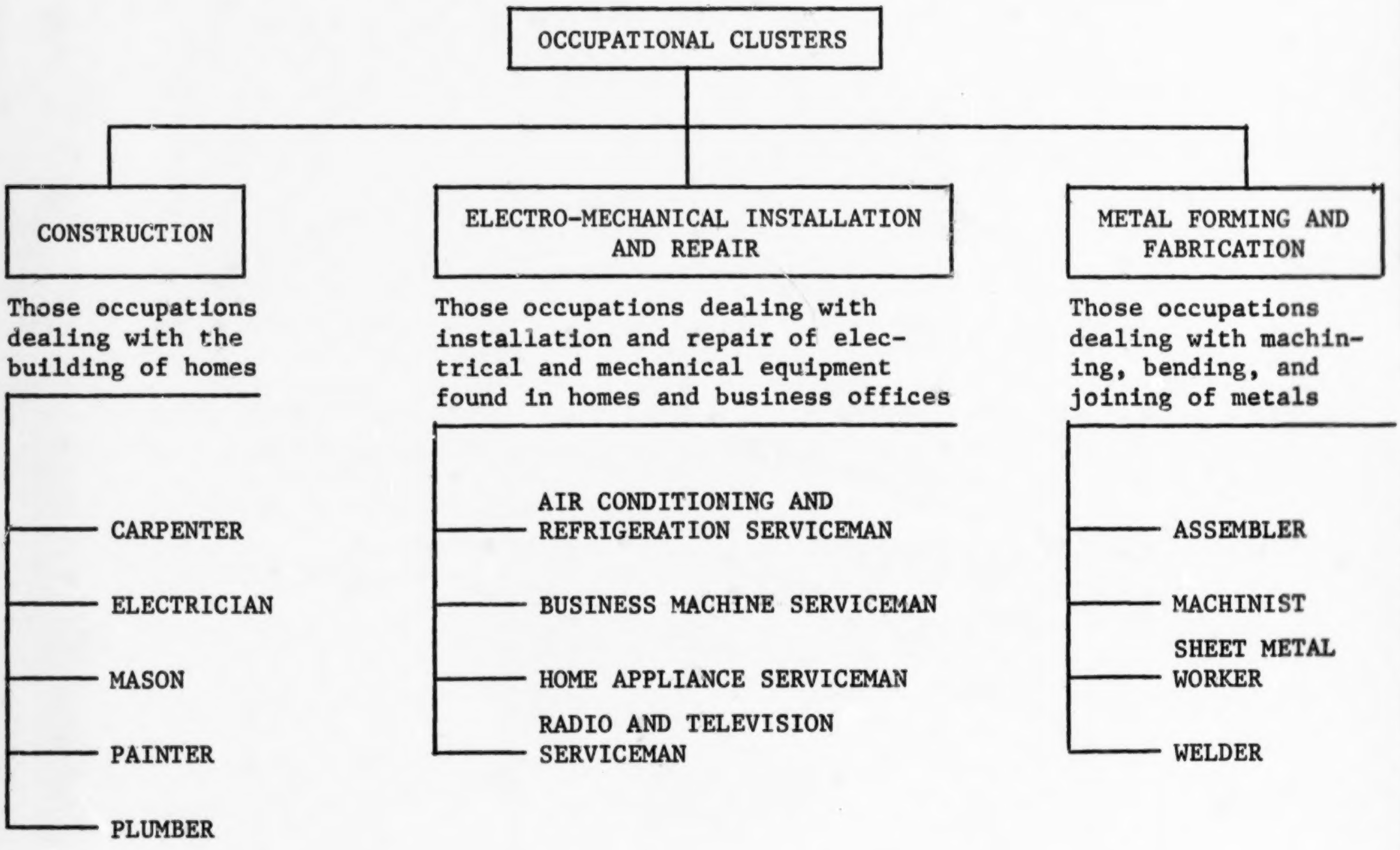
OCCUPATIONAL CLUSTERS
CONSTRUCTION
Those occupations dealing with the building of homes
CARPENTER
ELECTRICIAN
MASON
PAINTER
PLUMBER
ELECTRO-MECHANICAL INSTALLATION AND REPAIR
Those occupations dealing with installation and repair of electrical and mechanical equipment found in homes and business offices
AIR CONDITIONING AND REFRIGERATION SERVICEMAN
BUSINESS MACHINE SERVICEMAN
HOME APPLIANCE SERVICEMAN
RADIO AND TELEVISION SERVICEMAN
METAL FORMING AND FABRICATION
Those occupations dealing with machining, bending, and joining of metals
ASSEMBLER
MACHINIST
SHEET METAL WORKER
WELDER

Figure 1 Occupational Clusters

3. Opportunity for job entry upon graduation from high school.
4. Numerous skills, knowledge and human requirements which would provide an opportunity for the identification of commonalities or relatedness with other occupations.
5. Opportunities for advancement through further schoolings as on-the-job training, or apprentice programs.

Central to the development of a course of studies required for field implementation of the program was the development of a task inventory for each occupation within a cluster. This procedure is outlined graphically in Figure 2. Tasks described the work performed by an individual in an occupation and consisted of observable human behaviors involving more than one area of human requirement. The human requirements, cognitive and psychomotor, that may be found in the performance of work by an individual in an occupation include:

1. Communications
   - vocabulary
   - symbols
   - drawings and blueprints
   - systems of communication
   - speech
   - English
   - maps
2. Measurement
   - time
   - temperature
   - weight
   - volume
   - length, width, and depth
   - meters (electrical and mechanical)
   - instruments
   - systems of measurement
3. Skills
   - hand
   - mental
   - machine

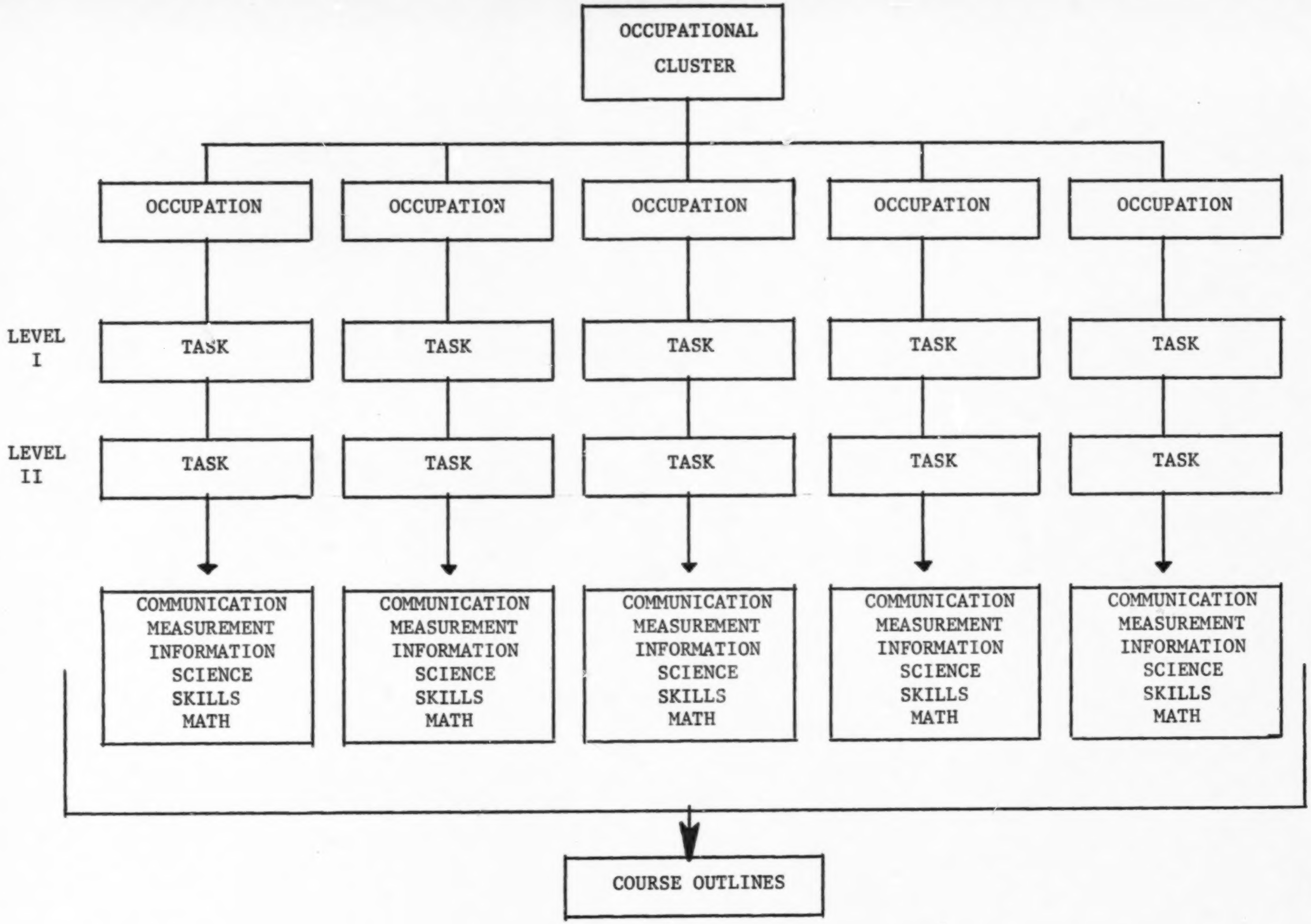
OCCUPATIONAL CLUSTER
OCCUPATION
OCCUPATION
OCCUPATION
OCCUPATION
OCCUPATION
LEVEL I
TASK
TASK
TASK
TASK
TASK
LEVEL II
TASK
TASK
TASK
TASK
TASK
COMMUNICATION MEASUREMENT INFORMATION SCIENCE SKILLS MATH
COMMUNICATION MEASUREMENT INFORMATION SCIENCE SKILLS MATH
COMMUNICATION MEASUREMENT INFORMATION SCIENCE SKILLS MATH
COMMUNICATION MEASUREMENT INFORMATION SCIENCE SKILLS MATH
COMMUNICATION MEASUREMENT INFORMATION SCIENCE SKILLS MATH
COURSE OUTLINES

FIGURE 2 RESEARCH MODEL FOR DEVELOPING COURSES OUTLINES

4. Mathematics and science
   - practical and applied

5. Information
   - technical
   - operational
   - occupational
   - economic
   - social
   - safety
   - personal hygiene
   - personal standards
   - occupational and job standards

The development of task inventories was accomplished through the review of job descriptions, textbooks, courses of study, training manuals, and active participation of recognized leaders from appropriate occupations. All tasks were written in behavioral terms using an action verb to describe the behavior, a noun identifying the object of the action, and adverbial or adjectival phrases describing the results of the action on the object. The format of task statements and an example of a task so written is shown in Figure 3. Modifiers were used to clarify the results of the action and to specify the accuracy or limits that were required in the performance of the task. Whenever possible, the task statement specified the tolerances that were required. By so stating the tasks, validity was satisfactorily achieved. The task statement could be used as a criteria for evaluation from one individual to another, and structured check lists for recording the field progress could be made.

After the task inventories were developed they were submitted to panels of experts from industry representative of the occupations forming clusters, for the purpose of classifying tasks into categories of (1) not

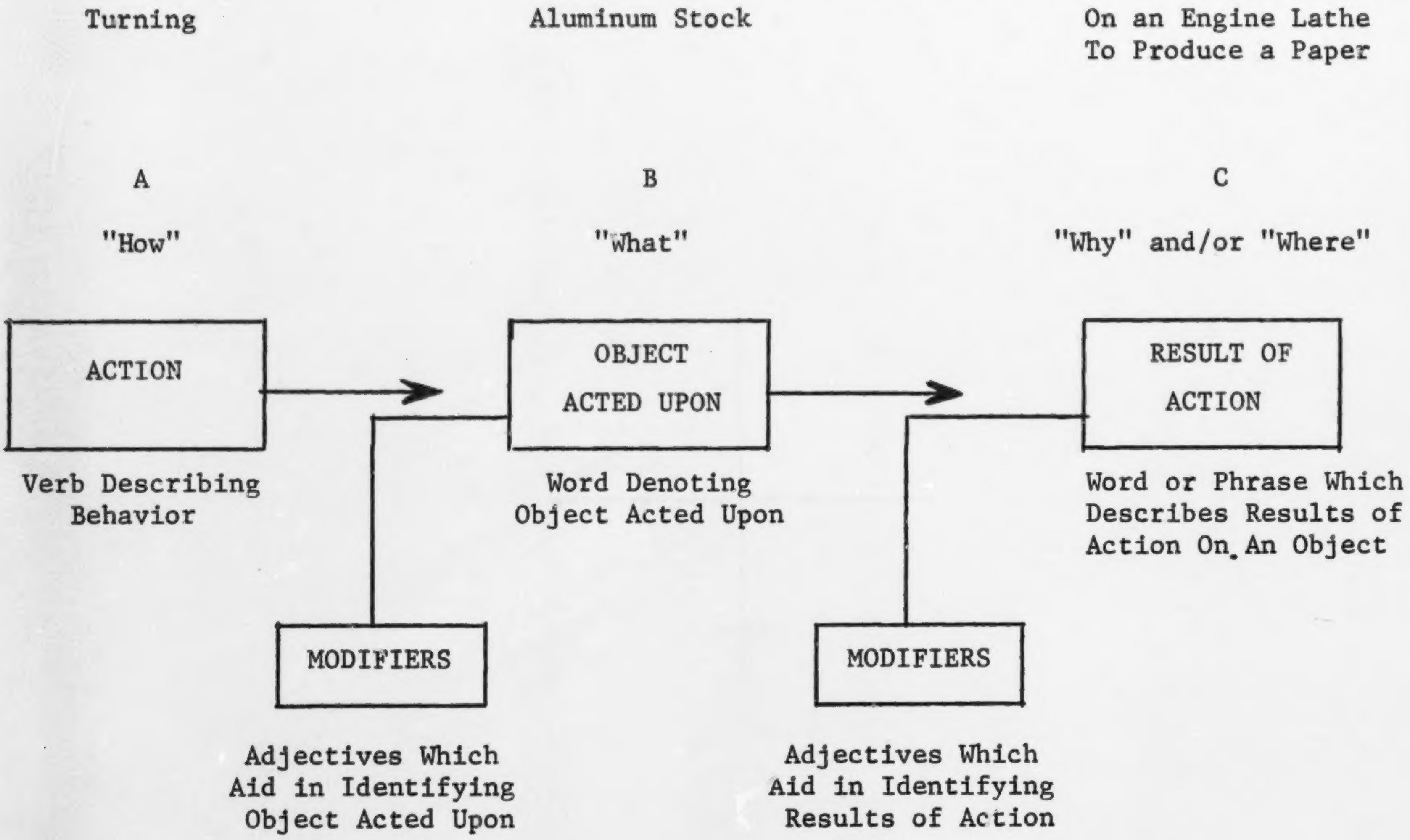
Turning
Aluminum Stock
On an Engine Lathe
To Produce a Paper
A
B
C
"How"
"What"
"Why" and/or "Where"
ACTION
OBJECT
ACTED UPON
RESULT OF
ACTION
Verb Describing
Behavior
Word Denoting
Object Acted Upon
Word or Phrase Which
Describes Results of
Action On An Object
MODIFIERS
MODIFIERS
Adjectives Which
Aid in Identifying
Object Acted Upon
Adjectives Which
Aid in Identifying
Results of Action

FIGURE 3 TASK STATEMENT FORMAT

required in an occupation, (2) required "entry-level" tasks within an occupation, and (3) required soon after entry into an occupation. With the results of this classification, it soon became evident by a frequency count for each occupation which occupations had a strength of relationship or similarity in human requirements. This information was used for the development of course outlines, for the building of achievement test items, student progress charts, and for evaluation criteria for use during visitation to the schools implementing the programs.

Phase II (September 1966 through August 1967)

The second phase of the project was characterized as having as its chief aims, the identification and training of competent teachers, and the further development of curriculum materials to implement the cluster programs.

With the cooperation of the Maryland State Vocational Department, thirty teachers were identified as candidates for the teaching of the new programs. After screening the candidates through a series of interviews and formal tests, and evaluating their professional qualifications and past teaching performances, eleven teachers were selected. Four teachers specialized in the Construction Cluster, four in the Metal Fabrication Cluster, and three in the Electro-Mechanical Cluster.

After careful study and research of the requirements of the cluster programs, the teachers were evaluated on their competencies, and their needs to implement the programs were identified. To meet these needs intensive training on campus and off campus was arranged. Private industrial and governmental organizations were available for establishing cooperative programs. Some of the cooperating organizations were: Sylvania Electric Corporation, Westinghouse, Technifax Corporation, Remington Rand Corporation, Associated Builders and Contractors, and the National Aeronautics and Space Administration.

Further activities of phase II included: (1) the development of instructional plans for the programs, (2) the acquainting of teachers with instructional materials and equipment, (3) the preparation of occupational information units, (4) arranging the content for each cluster in an instructional sequence including the tasks and human requirements as specified in phase I.

Phase III (September 1967 through August 1968)

The primary purpose was to evaluate, in a "field setting," the adequacy and effectiveness of the curriculum guides, course outlines, and preparation of the newly trained teachers. Descriptive, comparative, and quantitative data were generated and gathered to assess the impact of the first year of the programs on the school administration, teachers, and students.

Full control of all the variables necessary for an ideal experiment was not achieved; therefore, phase III was completed in the tradition of quasi-experimental design with full recognition of the factors which render the results equivocal.

Subjects from ten senior high schools in four Maryland counties have participated in this project. See Table I. One school had two cluster programs, each taught by a cluster concept instructor; thus,

TABLE I.

NUMBER OF SUBJECTS COMPLETING THE PROGRAMS

School	Teacher	Number of students cluster or experimental group	Number of students control group
		Construction Cluster	
A	108	15	17
H	101	16	12
D	102	16	7
C	106	14	11
		Totals 61	47
		Metal Fabrication Cluster	
B	110	17	17
E	105	16	10
F	111	12	8
J	104	15	10
		Totals 60	45
		Electro-Mechanical Cluster	
K	103	0	0
M	109	13	14
G	107	9	11
		Totals 22	25
		Grand Totals 143	117

eleven teachers and eleven separate cluster programs were included. Each cluster program was compared with a control group composed of students from a traditional vocational education course. Each school was considered and evaluated as a separate experiment.

Problems. To obtain an indirect estimate of the effectiveness of the cluster concept programs, three principal areas of investigation were conducted. These were:

1. The impact of the three cluster concept programs on selected cognitive and affective behaviors, and task performances (psychomotor behaviors) of students.
2. The adequacy and appropriateness of the content of the newly developed courses and instructional materials.
3. The educational process, its adequacy and appropriateness with a consideration of administrative support, teacher effectiveness, and selected environmental conditions.

To investigate the first area (1) of research, the changes of behaviors of subjects from the experimental and control groups were evaluated by the administration of a battery of tests at the beginning and at the end of the school year. See Table II. The tests included newly developed achievement tests for each cluster, the Minnesota Vocational Interest Inventory, the D. A. T. Mechanical Reasoning Test, and an instrument to evaluate the students' knowledge of occupational information.

Treatment of data. Comparability or homogeneity of the students forming both groups was established on the basis of intelligence test scores (lingual or verbal abilities), and in one school, on the Mechanical Reasoning Test. In all but two experiments the analysis of variance

TABLE II

VARIABLES OF PRE- AND POST-TESTS

Domain	Instruments	Factors Evaluated
Cognitive	Cluster Concept Achievement Test	Human Requirements* 1. Vocabulary 2. Measurement 3. Skills 4. Math and Science 5. Information
Cognitive	Mechanical Reasoning Differential Aptitude Test (The Psychological Corporation)	Applied science and mechanical reasoning
Affective	Minnesota Vocational Interest Inventory (The Psychological Corporation)	Interest patterns in relation to: 1. Carpentry field 2. Mechanical field 3. Electronics 4. Machinist 5. Painter 6. Plasterer 7. Sheet metal 8. Radio & TV
Cognitive	Occupational Information	Availability Status role Expectations Mobility
Psychomotor	Task Inventory Sheets	Performances of specific tasks derived from manipulative jobs required for each cluster.

*Based on analysis of occupations phase I and II.

statistic was used to determine whether there were significant differences between the two groups on the basis of the derived data. Prior to testing four differences, the F max ratio was used to determine homogeneity of variances. Non-parametric statistics were used in two experiments. The .05 level of significance was considered minimal in all data analyzed.

Findings. Statistical analysis of achievement test data indicated the following:

(a) Three construction cluster programs out of four achieved significantly higher scores than the control group. Three schools also were distinguished as making significant gains on the basis of the differences between the initial and final scores. One school made very modest insignificant gains. None of the control groups achieved significant gains on the achievement tests.

(b) All four schools implementing the mental forming and fabrication cluster program made significant gains on the achievement tests; whereas no significant differences were observed from the control groups. All experimental groups achieved significantly higher scores than the control groups on the posttests.

(c) Three schools initially were involved with the implementation of the electro-mechanical installation and repair cluster. Due to many failures to meet required specifications, one school operation was discontinued.
Of the two remaining schools neither achieved significant gains or significantly higher scores than the control group. One of the dominant factors influencing these results was that the control group consisted of boys who had been exposed to one or two years of vocational education in electronics.

(d) Data derived from the D. A. T. Mechanical Reasoning Test (from each of the ten experimental and control groups) indicated that both types of vocational education programs had insignificant effects on the development of the abilities required to solve problems of applied science and technology.

Affective behaviors. Both groups were administered the MVII and the supplementary questionnaire at the beginning and at the end of the school year.

Findings. The data derived from the MVII were perplexing and generally unsatisfactory for a clear group analysis. No clear patterns or directions of student vocational preferences were found. The cluster groups showed more flexibility of occupational choice than did the control groups.

Within the various groups of subjects, it was found that between twenty-five and forty percent of boys were dissatisfied with high school and would prefer to be gainfully employed or to pursue on-the-job training.

The number of students who expressed an appreciation for obtaining broad entry level skills, as opposed to specific in-depth training in high school, increased significantly.

Task performances. In the second (2) area of study, field observations and records of specific overt behaviors of students and teachers were made. The specific behaviors were referred to as job tasks and were set forth in objective behavioral terms. The tasks were incorporated into the course materials, inventory charts, and evaluation charts. The teachers' progress in implementing the instructional materials and student progress were recorded by the use of these devices.

Findings. The range of tasks (as structured into the programs) completed by the instructors of the construction cluster was from thirty-four to sixty-seven percent. Of the tasks completed from fifty to sixty-six percent of the tasks must be restudied by the students.

The metal forming and fabrication cluster group completed from fifty to sixty-seven percent of the tasks. Of these, it was projected that twenty-five to thirty-four percent of the tasks must be retaught.

The instructors implementing the electro-mechanical installation and repair cluster completed fifty percent of the tasks. Of these, two thirds will be repeated in the second year.

The primary cause for the failure to complete specified tasks was due to the lack of equipment, materials, tools, and some inadequacy in physical facilities. Causes for repeating tasks were: the complex nature of the tasks and the shortage of time for exercises due to delays in remodeling or in setting up laboratories.

The third area (3) of investigation was concerned with the evaluation of selected supportive dimensions including: (a) administration, (b) the teacher, (c) physical facilities, and (d) community acceptance.

In addition to anecdotal records, the following devices were used to obtain descriptive data: (1) personal vita and records of teachers, (2) survey inventory forms for tools, equipment, and materials for each cluster, (3) drawings and sketches of physical facilities, (4) visual media such as drawings, plans, photographs, and written descriptions of practical work performed while implementing the course outlines, and (5) student progress charts and student evaluation charts.

Findings: construction cluster. Administrative support from the state, county, and local levels ranged from enthusiastic verbal support to active participation in overcoming the problems of procurement of physical facilities, materials, and equipment. Since these problems were never fully resolved, various construction tasks were not completed. Consequently, the sequence and balance of the programs were disturbed. Some tasks were overemphasized and in a few situations, omitted altogether.

Various activities of interaction with the community were observed. Resourceful teachers obtained materials from local industries and arranged for student employment during the summer months. One field operation reported job placement of ninety percent of the students.

Findings. metal forming and fabrication cluster. Four separate field operations were involved with implementing this type of cluster program. The programs were restricted in different ways and varying degrees due to the lack of equipment and materials. The use of shops which were designed for the study of a single occupation did not provide sufficient working area and in some cases sources of power had to be added. This group of cluster teachers was evaluated to be most effective in meeting the goals and objectives of their respective cluster programs.

Findings. electro-mechanical installation and repair. This cluster program did not escape the damaging effects caused by inadequate supplies, materials, and equipment. The requisition-acquisition time lag strongly suggests that all programs should have been in operation several years before the optimum potential of these programs could be achieved.

One field operation was dropped due to failures in meeting the specifications of the cluster programs.

Conclusions

The action research conducted provided data which made it evident that the cluster concept programs have the potential of becoming vigorous, alternate forms of vocational education. The programs changed student behaviors in the direction of the established objectives. Changes in cognitive abilities, broadened interests, flexibility of occupational choices within a cluster, and growth in performance tasks were observed.

The inadequacies identified served to establish a list of recommendations for the further development and refinement of the cluster concept programs. The knowledges and experiences gained provided a basis for making realistic plans and expectations for meeting the problems of phase IV.

The subjects of this experiment will be completing their final year in high school and the second year of the two-year cluster program. Placement and follow-up studies are planned to obtain further information as to the relative merits of the new alternate form of vocational education.

CRITIQUE OF PAPERS PRESENTED IN THE SYMPOSIUM

"THE JOB-CLUSTER CONCEPT AND ITS CURRICULAR IMPLICATIONS"

Dale G. Hamreus

Oregon State System of Higher Education*

The responsibility of a discussant, as I understand it, is to discuss the pros and cons of the papers presented in the symposium. I shall give brief attention to each of the four papers in that regard and then attempt to look at a few issues that are more broadly related to the general symposium topic.

First, the Sjogren paper concerned with A Functional Approach to Curriculum Development. To argue as Dr. Sjogren does that the job cluster approach automatically results in a more general curriculum thereby (1) turning some students off and (2) inadequately preparing the dropout with salable skills and knowledge, distorts what I perceive to be the purpose of clustering methodologies. Job clustering is not the building of curricula. It is simply a tool whereby improved insight can become available regarding what and how jobs appear to be similar one with another. Once such information is available, and assuming it is valid, the task still remains to determine a strategy for converting this information into curricula that are effective in training the skills appropriate to a cluster of jobs.

Another point at which I disagree with Dr. Sjogren is in reference to his discussion of prescribed and discretionary contents of a job. I can accept the general statement that job contents can be characterized as prescribed and discretionary; however, I disagree that job analysis procedures tend to elicit only prescribed contents and ignore discretionary contents. The burden is upon the person gathering the job information. If job descriptions are being obtained at the incumbent level, for example, nothing whatsoever prevents the interviewer from soliciting discretionary as well as prescriptive elements. However, to limit the total domain of job description to such a simplified two dimensional structure as prescribed and discretionary contents at this point in our knowledge would, in my opinion, be unfortunate. Use of the terms prescribed and discretionary in analyzing job contents tends to dichotomize and polarize the analysis, when, in fact, the relationship between prescribed tasks and choice of tasks is probably quite complex and variable. It would be much wiser, I feel, to seek as comprehensive descriptions as possible of activities engaged in by incumbents and the settings within which they operate and begin to analyze the ways in which they appear similar and dissimilar.

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*Teaching Research, a Division of the Oregon State System of Higher Education, Monmouth, Oregon

On the positive side, Sjogren rightly placed first importance on the criterion problem in job clustering. Without question this has to be the greatest single issue confronting those who are struggling with clustering methodologies. Until we can reach general concensus on the relevant variables for describing jobs and the techniques for deriving meaningful job clusters from these variables, only limited application of such methodologies can be expected across the country.

Another point of agreement I have with this paper is the reference to jurisdictional disputes, which obviously are not unique to vocational education. Job clustering, however, tends not to conform to antecedent lines of separation in vocational education. To insert new cluster curricula obviously calls for change. Unfortunately, to bring about significant changes to stable practices in the educational establishment is said to take twenty years. If this is true, vocational education will have a long wait before cluster curricula will become generally accepted. Hopefully new strategies for overcoming jurisdictional entrenching will be found.

Next, the paper by Cunningham entitled A Conceptual Framework for the Study of Job Similarity. This paper is basically directed towards answering one major question: what are the variables for clustering jobs? Cunningham does an excellent job of reviewing the literature that might contribute to this question; however, no criteria (as expressed by Sjogren) are available to him to judge from the existing studies what parts to draw upon. The effort according to Dr. Cunningham is hopefully to avoid a syncretic product and to produce an eclectic general framework for defining and interrelating job variables. The result presented in the paper is a massive taxonomy that, if eclectic, has certainly merged many elements of several theoretical learning constructs and research based studies into one. Whether eclectic or syncretic, the task confronting Cunningham and his associates of organizing this comprehensive taxonomy into manageable job-analysis instruments, possessing operational definitions that clearly distinguish one category from another, is monumental.

One can hardly argue against the classes of job variables selected; however, the question that occurs is, are all the extracted elements indeed valid?

Regardless of the size of the task set forth by Cunningham, his effort to define a larger universe in job clustering must be recognized as outstanding. Only from aggressive leading such as this can we hope to achieve progress. Next steps will necessarily call for clarification of methodological strategies of recording job descriptions, classifying them under the many job variables, coding these classes such that statistical treatments can be carried out, and making meaningful analyses of the results. This appears to offer an exceedingly comprehensive and interesting line of research that should contribute significantly to our knowledge of job clustering.

My comments will now be directed to Rahmlow's paper on the Applications of Cluster Research to Curriculum Development. I get the distinct impression from this paper that curriculum development via job clustering is constrained within a closed loop universe. In other words, all the necessary information for planning the content of curriculum is available from job clustered data. I cannot accept his premise. Irrespective of how sophisticated we eventually get in job clustering and skilled in converting this data into behavioral objectives, it seems inconceivable that through this means alone, we will be able to isolate all the relevant needs for training. Job clustering can perhaps in time become very helpful to curriculum development; but until we become more skilled than is presently the case in extracting and organizing comprehensive descriptions of jobs, it can hardly be considered more than an adjunct resource to be used with care.

One of the purposes of the paper as stated by Dr. Rahmlow was to concentrate on the use of cluster data for curriculum development. Unfortunately the paper left me with the feeling that curriculum development is a simple task and one that can be very perfunctorily done. I probably got this notion because the examples used, e.g., adding fractions, are limited to just the knowledge element of training and as such are readily communicated and easily understood. Curriculum development obviously must be concerned with many other elements than just knowledge, which greatly increases the complexity of the task. It would have been more appropriate, perhaps, if Dr. Rahmlow had made clear in his paper the limitations in curriculum development of just the knowledge element and cautioned the reader to these limitations.

It was very encouraging to see the emphasis Rahmlow gives to utilizing cluster data toward individualizing instruction. I feel this is of great importance. When combined with the notion of bringing career guidance into cluster curricula, the results should provide for a much stronger vocational program that can become adaptive to the learner's needs and improve the articulation between educational levels.

Now for a few remarks about the paper by Mietus entitled The Development, Implementation, and Field Evaluation of the Cluster Concept Programs in Vocational Education at the Secondary Level. This paper reports a successful effort to implement a vocational education clustering program. The criticisms I have are limited only to methodological weaknesses.

First, it is not completely clear how the task inventories were obtained; however, they do not appear to have been derived from actual current jobs; i.e., from job incumbents. One must therefore raise the question of task statement validity. Task analysis research conducted by HumRRO, as well as some of my own, indicate that the further removed the gathering of job descriptions is from actual job incumbents the less valid it is likely to be. Such findings raise doubts about the validity of the task statements as reported by Mietus.

A second weakness, in my judgment, regards the evaluation design employed in the study. Since this was a developmental effort, the application of a comparative design for evaluation is inappropriate. No standards could be realistically fixed at that time whereby reliable comparisons could be made. It would have been considerably stronger to have used an objectively based evaluation design in which such factors as relevance, effectiveness (against stated goals), acceptance (by industry, school staff, students), and robustness were employed.

Much can be learned from the reported study regarding the implementation of a new program in the educational establishment. The approach used of involving people appears particularly powerful in meeting the change problem. Not only were school people and students involved in the new development, individuals from industry, community leaders and parents were also a part of the larger team. Such a strategy obviously worked and even though certain technical questions can be raised regarding the research design that was used, the simple fact remains that the study was successful in getting a new curriculum inserted into the program.

I have just a couple of general points to make regarding job clustering and curriculum development. None of the papers gave any attention to the question of cluster curricula that prepare learners with capabilities to meet future job requirements. If all our attention in job clustering is limited to just today's jobs, the resulting curricula we might develop would always be a step behind newly emerging job requirements. What is needed, in addition to perfecting job clustering methodologies, is to give some of our attention to the problem of projecting future job descriptions and the means for their subsequent clustering. Once such procedures have been defined, iterative processes can be employed to improve projection accuracies to acceptable limits.

The other point I want to discuss concerns the implication of career choice to curriculum development when job clustering does become an operational tool. Presuming that we can efficiently learn to generate clusters of jobs and translate them into effective cluster curricula, we should then possess a powerful means to prepare learners with the capabilities to work within the several jobs making up the cluster. The advantages of this concept in terms of more efficient use of instructional resources and better preparing future workers to adapt to job obsolescense have been discussed. However, unless students can acquire a much broader and deeper understanding of the many and varied types of jobs available than is currently the situation, simply to make a more effective and efficient set of curricula based on job clustering will in no way guarantee that students will understand the potentials of such curricula or be motivated to learn from them. It seems to me that equal energies must be given in job clustering studies to the questions of career choice clusters and how to design information systems which are effective in sensitizing students to the many occupational possibilities such clusters offer.

JOB CLUSTER CONCEPT AND ITS CURRICULAR IMPLICATIONS: DISCUSSION OF A SYMPOSIUM

Edward J. Morrison

The Ohio State University*

If I read our speakers correctly, each is in hot pursuit of perhaps the most appealing and durable of educational goals--"the powerful curriculum." Each would invest the student's time as profitably as possible by having him concentrate on the acquisition of those capabilities which are in widest demand, or which are prerequisite for most later learning, or both. Though not all said so explicitly, I am reasonably sure all of our speakers would approve a search for a curriculum which was powerful not only with respect to vocational competence but also in preparing students for responsible citizenship and for self-fulfillment. The ideal curriculum, they might agree, would be one which prepared students for the largest number of all life activities, given the practical limitations which happen to prevail. At any rate, it usually is not hard to get agreement among almost any group of people that the power of a curriculum is one important measure of its value.

What is not easy is to specify a demonstrably powerful curriculum. What, specifically, are the capabilities which, if acquired, would give the student greatest occupational flexibility? This is the question addressed so thoughtfully by our speakers.

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[*] Center for Research and Leadership Development in Vocational and Technical Education

I found each of the papers to be stimulating and must confess that I was tempted simply to take each in order and discuss serially the several fascinating questions raised by each paper. Before permitting ourselves that luxury, however, we should come to grips with the more difficult and fundamental problem shared by all of these papers: namely, the "job cluster" as a strategy for identifying elements of the powerful curriculum.

A simplified account of the "job cluster" strategy might be as follows: one examines a wide variety of jobs and sorts them into groups according to the kinds of tasks, skills, knowledge, aptitudes, work habits, or whatever the jobs require for success. Each group or cluster of jobs thus is defined by a set of common requirements. These common job elements, incorporated into the curriculum, provide the student with powerful capabilities which are useful in a number of occupations. Our speakers have described a variety of bases for clustering jobs and several procedures for arriving at curricula once the clusters have been defined, but the general strategy is essentially the same for all: define a core curriculum based on common requirements of job clusters.

Let's suppose, for the moment, that the difficulties, with which Sjogren and Cunningham wrestled, of defining job clusters were solved and we had organized all jobs into clusters of various sizes. What could we do with that result?

Well, if we had no vocational program in operation, we might select the largest cluster (i.e., the one including the largest number of jobs) and develop a curriculum for that cluster since it would include acquisition of competencies useful in the largest number of jobs. Please notice, however, that this curriculum might not be recognizable as different in any way from curricula already existing to prepare students for one of the specific jobs in the cluster. Since the cluster, and hence the "core," is defined by those elements required by every job in the cluster, any curriculum adequately preparing students for any one of the jobs in that cluster must, by definition, already include provision for the capabilities defining the cluster. Careful analysis of job requirements, perhaps including modifications like those suggested by Sjogren and Cunningham, can be an invaluable aid to assuring that our curricula prepare people for real requirements. Defining clusters of jobs according to common requirements can be of great assistance in choosing our vocational offerings and in doing several other things I would like to discuss next, but the identification of common job requirements does not provide new content for curricula already preparing students for the specific jobs in the cluster. Curricula which include preparation for jobs in large clusters are more powerful than curricula preparing for jobs in small clusters, but the identification of clusters does not tell us directly how to improve the power of existing curricula.

Knowledge about these clusters can be used in several ways, however, to accomplish important educational objectives. One could, for example, use the fact of job clusters in assisting students to make effective educational and vocational decisions. A student would be well-advised to choose a sequence from the largest job cluster for which his capabilities and interests were appropriate.

A second important value of clusters is the guidance they provide to training students for transfer. Thus, when students are attempting to acquire one of the capabilities common to jobs in a cluster, the fact of its general usefulness could be pointed out to them with examples. More important, application of the common capability to specific instances or tasks selected from at least several of the jobs in the cluster could be required. I believe that the work reported by Mietus and by Rahmlow includes this technique. Positive transfer of learning will be enhanced by exercise of a capability in the contexts to which transfer is desired and clusters can assist greatly in this process by identifying important contexts.

A third assist provided by the identification of job clusters is due to the possibility that they may provide guidance to the selection of reasonable additions to the curriculum. Thus, since jobs in a cluster share substantial requirements and are the jobs among which graduates are best advised to switch, they also are the logical source for capabilities which might be added to a curriculum. If we are lucky, there will be requirements shared by some, but not all, of the jobs in a cluster. These are prime candidates for such vocational exploration as can be provided. Even if no such sub-cluster can be identified, the higher probability of job switches within a cluster would argue for selecting additions to the curriculum from even specific capabilities required by other jobs in the cluster.

Finally, it may be noted that the identification of job clusters can facilitate various administrative functions, including the selection of students and employees and the assignment of faculty.

All of these benefits from the study of job clusters are important and serve as justification for the enterprise. But job cluster identification seems a weak strategy for increasing the power of vocational curricula basically because job definitions are arbitrary, variable and based on practical rather than theoretical considerations. Significant progress toward deliberate control of curriculum power awaits the evolution of some means for accounting systematically for the ways in which jobs (and other life activities) can vary in their requirements for human performance.

Symposium Papers

Cunningham, J. W. A Conceptual Framework for the Study of Job Similarities.

Mietus, W. S. The Development, Implementation and Field Evaluation of the Cluster Concept Program in Vocational Education at the Secondary School Level.

Rahmlow, H. F. Application of Cluster Research to Curriculum Development.

Sjogren, D. D. A Functional Approach to Curriculum Development.